

Forum: United Nations Environment Programme

Issue: The question of carbon capture technology and its viability to be implemented worldwide

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Introduction

When there is too much carbon dioxide in the air, it starts to become a poisonous gas. Not only humans, but also other animals can face respiratory failure and impairment to their nervous system. To add, the toll that it can take on this planet is far worse and centers around climate change - more specifically, the notorious “greenhouse effect”. According to the UN, “1 million species of animals and plants face extinction due to climate change and human activity,” a lot of which is essentially the product of immoderate carbon dioxide, as it is one of the primary greenhouse gases.

Carbon Capture and Storage technologies are methods and machines that were introduced to try and help solve this issue. Although it is a start, the amount of Carbon Dioxide collected by Carbon Capture Technology in 2018 was only 40 million metric tons of the 5 billion metric tons of Carbon Dioxide. That leaves 4 billion, 960 million metric tons left, damaging the earth and only 0.8% of the harmful amount actually captured. Carbon Capture Technology is one of the main solutions which could admittedly make a difference to climate change, but even scientists predict that along with the natural solutions (trees and plants), there is simply not enough space or money to actually be able to do something world-changing.

Carbon Capture Technology and Storage in itself does not have many positives other than the environmental benefit. It actually has negatives in terms of economical and social factors, which are so utterly important when discussing this matter. That is one of the reasons why almost every country across the world has a Carbon tax, which is a tax for any Carbon Dioxide emitted. This is one of if not the biggest motivator for energy and oil companies to implement practices such as the use of Carbon Capture Technology and Storage. This adds an economic advantage to most companies when using said technology. As well as that, if Carbon Dioxide is captured correctly and early, it can also be sold to other companies or used by the original company.

Definition of Key Terms

The Greenhouse Effect

The heat from the sun is constantly entering and exiting the Earth's atmosphere, but when certain gases such as greenhouse gases or too much of them are emitted, they tend to trap this heat in the Earth's atmosphere, playing a large factor in climate change and global warming.

Greenhouse Gases

Greenhouse gases are the gases which cause the "greenhouse effect" as many of them absorb/emit energy, such as heat energy coming from the Sun. Some commonly known and most effective examples include Carbon Dioxide, Water Vapor, Methane, Chlorofluorocarbons, Ozone, and Nitrous Oxide.

EOR

EOR stands for Enhanced Oil Recovery. Regular Oil Recovery usually refers to the extraction of crude oil, but EOR methods are specifically used when the oil is not able to be extracted using general methods.

Carbon Tax

Carbon Tax is a tax that is implemented in multiple countries across the globe. It taxes companies and factories highly when carbon dioxide is emitted into the air. This was implemented to try and encourage the use of Carbon Capture Storage and Technology .

Key Issues

General Use

Carbon capture technology was really only recognized when there was a seemingly commercial or economically beneficial way of using it. However, this idea of marketing soon plummeted as only a little amount of carbon dioxide can be used and sold when captured properly and early, and many companies can't afford to store all of it, defeating the whole purpose. So if more and more CSS is implemented, it could cost billions, and Carbon is never going to stop being produced and will always need to be captured and there is only so much space for it to be stored and only so much of it that is viable to be used, and the remaining would put billions of dollars, tons of hard work, and the entire movement about climate change to waste.

EOR

A perfect example of how carbon capture technologically is inconvenient to be used commercially is shown in Enhanced Oil Recovery. As mentioned previously, the first sales of Carbon Dioxide weren't as glorious both economically and environmentally as they seemed. Not only could Carbon Dioxide only be used alongside alterations of water to create Carbon Dioxide floods, but it also was difficult for it to be used within larger, faster, and more successful companies. Alongside that, the Carbon Dioxide could only be used for this method when captured in earlier processes which could not be done in most places where it's often emitted and this didn't encourage companies to actually

utilize the technology, because either the whole system of production would have to change, potentially causing economic loss, finding a way to store the un-useable carbon dioxide which once again would warrant much more hard work and costs, or in most places, just freely emit it. It is obvious that many companies were forced to pick the last option because even after the spread of CSS all over the United States, only around 120 Carbon Dioxide floods are still in use globally.

Funding

It may seem pretty obvious that funding is one of the main issues while working with CCS, but if potentially overcome, there are slim to none problems that can't be tackled from then on. The statistics needed to fully eliminate this issue are near to impossible without appropriate funding to many different parties.

Investing

Although big organizations such as the Elon Musk foundation are willing to use around 100 million dollars for Carbon Capture, investments from foundations and companies have an extremely low chance of working. With the statistics that in 2021, there are around 8 billion metric tons of unnecessary carbon dioxide, up to 500 million dollars are invested in each unit, and there are multiple across the globe. However, it costs 58.30 dollars for a single ton of Carbon Dioxide to be captured. If it was planned to capture each unnecessary and harmful metric ton of Carbon Dioxide using the amount from 2018 with the technology of 2021, it would cost 460 billion, 400 million dollars. That amount of money rounds out to around 250% of the world's richest man's wealth. Even with the small amount that is still being captured with the budget in mind, it still uses billions of dollars and does not even get the amount of carbon in the atmosphere anywhere near a safe or understandable level.

Inconvenience

One of the main reasons that CCS isn't as effective is because of the refusal and lack of competence with many major electricity companies. When the law does not force said companies to comply with Carbon Capture Technology, then it is usually not done at all because it is not necessary or important to production. Many companies focus on money and production and the environment is not a main factor to their decisions, especially since with the implementation of CCS in power plants, the companies cannot or choose not to afford to both produce electricity and also capture the carbon. Firstly, this is because it is a major inconvenience to the company's system and schedule and is a disruption even when maintaining value of the company and second of all, there is no encouragement to capture the carbon and to pay to store it at all as the Carbon Dioxide produced during the making of electricity would cost more to sell than it would to emit.

Major Parties Involved and Their Views

The US Energy Department

The US Energy Department holds its role in its name, energy. One of the topics that affects the nation greatly through energy is excessive Carbon emissions. Not only does the greenhouse effect trap the sun's heat energy inside the Earth's atmosphere, the ripple from that affects the United States quite a bit. For energy companies as well, Carbon emissions is one of their biggest issues and it is an extreme difficulty and inconvenience for many of these companies to cooperate with Carbon Capture Technology while still producing and maintaining the amount of Energy produced. The US Energy Department made the seven regional partnerships focused on CCS, which is practically the formation of a network across the entire nation consisting of agencies, universities and companies so the implementation and research based on it is easily accessible and easily done without having to go through the energy department or government to indirectly get access to the necessary resources.

The US Federal Government

The US Federal Government is a very powerful governing body and their relation and control over national policies, taxing, and costs is affected majorly by the nation's "Carbon footprint" and effect on climate change. For example, gas emissions taxing is in many countries across the world, including the US, and for climate change, the US is affected by heatwaves, floods, wildfires, and much more, the budget of which takes up a fair share of the nation's budget. To try and stop this waste of money and taxes, the US Federal Government has made many past efforts to try and tackle greenhouse gas emissions, providing as much as 1 billion dollars for an initiative for a power plant, FutureGen, that does not create greenhouse gases. Although this is not particularly "carbon capture" technology, it steps in the exact same direction. They have also updated this technology since and has restructured FutureGen multiple times.

The UK

Polls in the UK have very clearly implied that voting citizens agree with a high implementation of Carbon tax. The Zero Carbon Campaign also said that almost 30 billion pounds could be raised annually through this tax within the next decade, and the total UK budget for carbon capture is only 7% of that number. In 2005, to take action, the UK implemented the UKCCSC which stands for the UK Carbon Capture and Storage Consortium. This Consortium used scientists to help focus on three main points. Costs of emissions and Carbon Capture Technology, the future supply and demand for energy and its impact, and the implementation of Carbon Capture Technology into the UK's general energy infrastructure.

The CCP

The CCP stands for the Carbon Capture Project and was the unification of 8 of the largest energy companies as well as three government organizations. Phase 1 of the project was initiated in 2001 worked together to try and implement CCS in as many ways as possible and proposed hundreds of ideas and plans just in the first few years in the

making. The first phase obviously focused on “screening/proof of concept”. Since, they have completed three phases in their project, the second phase lasting from 2004-2009 and being centered on “intensive development”, the third phase lasting from 2009-2013 and being centered on, and their fourth phase which started in 2014 and is still ongoing to this day. Even though the project is stated to currently be focused on further understanding and research, not many big decisions or solutions were made in the past few years and most phases of the CCP usually last 4-5 years while it is the 7th for phase 4. While this wouldn't be considered extremely unusual as it is not often for advancements in CCS to take place easily, not many are aware of the next phases to come.

Development of Issue/Timeline

Date	Event	Outcome
1977	First use and implementation of Carbon Capture Technology	Although the IEGHG states that different methods of what can be considered as Carbon Capture Technology had been used and in the making, there was a lack of awareness, funding, and viability. So in 1977 in the UK, the idea of capturing Carbon and using it to advance Oil Recovery was first used. The process would be called “Carbon Dioxide Floods” because it was an alternation of injecting Carbon Dioxide and Water for EOR. This gave not only a way for

		Carbon Dioxide to be rid of instead of storing it, but big oil fields in the USA would invest/buy carbon because of this and to this day, there are still hundreds of Carbon Dioxide floods globally.
1991-1996	The first instituted tax for Carbon Emissions	In 1991, Norway instituted a tax for any Carbon Dioxide that was emitted. Over the next 6 years, Norway's largest and most successful oil company known as Statoil required their Sleipner natural gas and light oil fields to implement Carbon Capture Technology to capture any Carbon produced/emitted in these fields and relocate it. However, considering the size of production of Sleipner, they started a project to build deep saline aquifers where they could pump any and all Carbon and were one of the few major oil companies to successfully maintain the use of Carbon Capture Technology over long periods of time, and large

		amounts of potential emissions.
2000	The CCP was created	In 2000, one of the most important projects based on CCS and their first phase was initiated. The Carbon Capture Project was created when multiple energy companies partnered to help tackle the issue of Carbon emission because it was a big factor into their economical, environmental, and ethical success. The CCP went on to create and plan some of the biggest advancements for Carbon Capture Technology.
2008	New software developed for Carbon assessment	In the Massachusetts Institute of Technology (MIT), their researchers designed and developed an assessment software that can be used for Carbon Capture Technology as well as Clean Coal Technology to measure the amount of Carbon Dioxide that can be stored underground. This not only gave every developer of

		Carbon Capture Technology an advantage, but it helped out Energy companies and gave a precise perspective on how to tackle the issue that there may not be enough storage for all Carbon Dioxide emitted and then captured.
2009	Global Carbon Capture and Storage Institute becomes an international initiative	During a forum meeting on climate change, the Prime Minister of Australia announced that the Global Carbon Capture and Storage Institute would officially become an international initiative and all this work would be done through Australia. This initiative included many other nations and some energy companies (ones also included in the CCP). One of the main focuses of this institute was focused on capturing Carbon from coal and seeing as the President of the US at the time was partnered in this institute, their research did benefit quite a bit and a coal power plant that

		doesn't produce greenhouse gases was created a few years later in the United States of America.
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Previous Attempts to Solve the Issue

Storage of Carbon Underground

Although this is known to almost anyone who is aware of Carbon Capture Technology, storing Carbon underground was widely popularized by Sleipner oil fields while trying to avoid tax. As said before, deep saline aquifers were used to store the carbon, which first came off as genius and is used as one of if not the main aspects of CCS. However, the reason that this can work subtly makes sense, but it is not a solution to the general issue. The tax instituted was so high, that spending a fortune on storage would not come near to the amount of tax that would need to be paid over time considering the company's large production - and avoiding it was a smart idea - but these aquifers are constantly needed to be taken care of and updated when necessary as well as sometimes having to relocate the Carbon, and constantly create more and more area for the storage of the carbon. Sleipner is successful but not successful enough to freely store all of the Carbon Dioxide for as long as expected. As well as that, what is still unknown is any incident or chance of the gas actually escaping this underground storage and going back into the atmosphere, just like what the whole idea was made to prevent.

The CCP

Even though the Carbon Capture Project initiated in the year 2000 is known to have made many advances, it gets its true title considering how early it was that this project was initiated and also the amount of effort it took. However, even though the CCP had the right intentions, there was only so much that could be done about Carbon Capture Technology, and even with the advances they were making, the emissions were increasing

and the Carbon level was hardly even maintained throughout these years. The CCP was mainly formed on a partnership from larger energy companies, but the actual project itself worked indirectly with scientific and technological fields. The planning and ideas for the CCP may have helped make a difference, but a lot of the actual execution did not follow through with all their plans and although hundreds of proposals were made, that does not confirm that hundreds were approved and implemented. The fact that this project rooted from Energy companies themselves, the focus was more on how to take away the Carbon emissions issue away from the companies and less on how to completely eliminate this threat. This is one of the common mistakes throughout projects and initiatives based on Carbon Capture Technology and the people surrounding them.

Possible Solutions

Inclusion of Touristic Nations

The CCP may have stated that it included governmental organizations when it was first initiated, however, the inclusion and support of said governmental organizations was not really shown or utilized to its advantage after phase 1. Obviously, laws and taxes which have taken place regarding carbon emissions made and still make a big difference, however, with the budgeting and power of nations and their governmental bodies, CCS has a much better and higher chance of being implemented safely. It could provide potential space for the storing of Carbon, and the funding needed to aim at successfully decreasing or perhaps one day eliminating this issue. And not all countries can be targeted ethically, but environmentally, climate change and global warming can affect many aspects of countries whether in a touristic or economic perspective. For example, one of the biggest issues affecting the tourism and overall economy of cities during the summer is the heat, especially for ones which mainly have their income off of said tourism. With Carbon emissions only growing and the planet getting warmer, the number of tourists is getting lower.

Using Afforestation

Replanting trees and forests is the longest known and used way to “capture carbon”. Although scientists have stated that just the use of trees, plants, and other natural aspects would make it close to impossible to balance out the level of carbon emissions, there have not really been many attempts to collaborate both the technological side of carbon capture and the natural one. For now, they both have the same goal but work completely separately. If the creation of carbon capture technology was focused to utilize and take advantage of the already existing processes that trees and plants use to capture carbon and use the same technique at a much higher level, it would be so much more economically and environmentally friendly as it would cost less than building the technology from scratch, and would take up less space as well as being an excuse to plant trees and solve other environmental problems.

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